UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/884,527	06/18/2001	Kevin R. Keegan	DP-304324	2648

7590 09/18/2003

VINCENT A. CICHOSZ
DELPHI TECHNOLOGIES, INC.
Legal Staff Mail Code: 480-414-420
P.O. Box 5052
Troy, MI 48007-5052

EXAMINER
CREPEAU, JONATHAN

ART UNIT	PAPER NUMBER
1746	4

DATE MAILED: 09/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/884,527	KEEGAN, KEVIN R.	
	Examiner	Art Unit	
	Jonathan S. Crepeau	1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 July 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Response to Amendment

1. This Office action addresses claims 1-25. The claims remain rejected for substantially the reasons of record under 35 USC §103. Accordingly, this action is made final.

Claim Suggestions

2. The clarity of claim 13 could be improved by adding the word --system-- after "stack" in line 1 in order to match the preamble of parent claim 14. Correction is suggested, but not required.

Claim Rejections - 35 USC § 103

3. Claims 1, 2, 10-14, 17, and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 8-268750 in view of Lessing et al (U.S. Patent 5,641,585).

Regarding claims 1, 14, and 17, JP '750 teaches a solid oxide fuel cell comprising an electrolyte (1), electrodes (2, 3), and interconnectors (4) in Figure 1 and paragraph 22 of the machine translation. Regarding claims 2 and 13, the interconnector comprises a conductive ceramic which may comprise a multiple oxide of lanthanum, chromium, and strontium (see abstract). Regarding claims 1, 14, and 17, the reference further teaches that the conductive ceramics of the invention can be used as a cylindrical resistive heating element operating at a

temperature of 400 to 1200 °C (see paragraph 23). The reference further teaches that the conductive material "is used as the separator etc. and heater element of a fuel cell" in paragraph 37. Regarding claims 23-25, the fuel cell is operated at a temperature of 1000°C (see paragraph 36). Regarding claims 10-12, the power to "heat" the interconnect is inherently less than or equal to 4.5 watts per cell, since the temperature to which the interconnect is heated is not specified by the claims.

While the JP reference teaches that the conductive material is used as a heater element of a fuel cell, the reference does not expressly teach that the *interconnects* of the fuel cells are used to heat the fuel cells, as recited in claim 17. The reference further does not teach that electrical supply connectors or a power supply are electrically connected to the interconnects, as recited in claims 1, 14, and 17.

The patent of Lessing et al. is directed to a solid oxide fuel cell (see col. 7, lines 40-45). The fuel cell comprises a resistance heating element (78) and its associated electrical connectors, controller (86), and power supply (82) (see Fig. 3; col. 6, lines 5-15).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated by the disclosure of Lessing et al. to connect the interconnects of the JP reference to electrical connectors, a controller, and a power supply, and to supply electrical current to the interconnects to heat the fuel cell. In column 6, line 16, Lessing et al. teach that "[a]s will be appreciated, the electrochemical combustion of hydrogen occurs at a high temperature. Without outside input, the level of reaction required to produce electricity in usable quantity can take hours to reach. With the addition of resistance heating element 78, this turn on time can be substantially reduced

or effectively eliminated." Accordingly, this disclosure would first motivate the artisan to heat the fuel cell of the JP reference with the interconnects of the JP reference, because the interconnect material is identified as a suitable resistive heating material. The disclosure of Lessing et al. would additionally motivate the artisan to use the associated elements of Lessing et al. (i.e., electrical connectors, a controller, and a power supply) to heat the interconnects. Additionally, regarding claims 22-25, the artisan would find it obvious to supply power to all interconnects of the JP reference at the same time so as to keep the starting time of the stack to a minimum, and also to heat the interconnects until they reach a temperature of 1000°C, the operating temperature of the fuel cell.

4. Claims 6, 15, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 8-268750 in view of Lessing et al. as applied to claims 1, 2, 10-14, 17, and 21-25 above, and further in view of JP 61-045569.

Neither JP '750 nor Lessing et al. expressly teach that the power supply comprises a battery, as recited in claim 15, or that the controller comprises a switch (claims 6 and 16).

The JP '569 reference is directed to a method of heating a fuel cell by using a switch (14) and a battery (15) (see abstract; Figure 1).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated by JP '569 to use a switch in the controller of JP '750 and a battery as the power source of JP '750. In the abstract, JP '569 teaches that by using its method, "it is possible to prevent any decrease in the

electromotive force of the fuel cell and to improve its starting characteristic." Thus, the artisan would be motivated to use a battery and a switch in the heating circuit of JP '750.

5. Claims 3-5 and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 8-268750 in view of Lessing et al. as applied to claims 1, 2, 10-14, 17, and 21-25 above, and further in view of Haltiner, Jr. et al (U.S. Pre-Grant Publication No. 2002/0004155) and Claar et al (U.S. Patent 4,883,497).

JP '750 further teaches in paragraph 35 that the thickness of the interconnect is 2 mm. However, the reference does not expressly teach that the thickness is less than 1 mm, as recited in claims 3-5 and 18-20.

The Haltiner, Jr. publication is directed to interconnects for fuel cell elements. In paragraph 33, the reference teaches that "thinner interconnects provid[e] a more compact stack assembly."

The Claar et al. patent is directed to solid oxide fuel cells. In column 1, lines 20-27, the reference teaches that an interconnect has a thickness of 0.025-0.1 mm.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated by the disclosure of Haltiner, Jr. to reduce the thickness of the interconnect of the JP '750 reference so as to provide for a more compact stack assembly. In addition, the artisan would possess sufficient skill to look to the patent of Claar et al. for suitable solid oxide interconnect thicknesses. As noted above, the Claar et al. reference discloses a thickness in the range of 0.025

to 0.1 mm, which lies within or overlaps with the ranges recited in claims 3-5 and 18-20. Accordingly, the subject matter of these claims would be rendered obvious to the skilled artisan.

6. Claims 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 8-268750 in view of Lessing et al., Haltiner, Jr. et al., and Claar et al. as applied to claims 3-5 and 18-20 above, and further in view of Fishbane et al (*Physics for Scientists and Engineers*, vol. II).

The JP '750 reference does not expressly teach that the resistance of the interconnect is greater than or equal to 1.2 ohms per cell, as recited in claims 7-9.

On page 805, Fishbane et al. teach that the amount of ohmic heating of a resistor (i.e. the power dissipated by the resistor) is proportional to its resistance. On page 793, Fishbane et al. further teach that resistance is proportional to length traveled by a current and inversely proportional to cross-sectional area that the current passes through.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the disclosure of Fishbane et al. indicates that the resistance of the interconnect of JP '750 is a result-effective variable that may be manipulated to affect the ohmic heating value of the interconnect. First, the artisan would understand that a higher ohmic heating value would be beneficial because the interconnect would produce more heat. Therefore, the artisan would be sufficiently skilled to optimize the resistance of the interconnect so as to produce a high ohmic heating value. It has been held that the discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980). Further, Fishbane et al.

provide guidance as to how to manipulate the resistance. As noted above, the reference teaches that resistance is proportional to length and inversely proportional to cross-sectional area. Therefore, since the current would travel through the interconnect of JP '750 in a direction along the length of the interconnect, this length could be made larger to increase the resistance of the interconnect. In addition, the artisan would have further motivation to decrease the thickness of the interconnect, as this dimension corresponds to the cross-sectional area that the current passes through. Accordingly, in light of the disclosure of Fishbane et al., the artisan would be sufficiently motivated to modify the interconnects of JP '750 so as to give them a high resistance, e.g., greater than 1.2 ohms.

Response to Arguments

7. Applicant's arguments filed July 10, 2003 have been fully considered but they are not persuasive. Applicants assert that the different functions of the ceramic material of JP '750 (i.e., the current collecting function and the heating function) are described and illustrated separately in Figure 1 and 2 of the reference. Applicants further assert that "JP 8-268750 teaches LaCrO3 suitable as the current collection material or the ceramic heater elements of a solid oxide fuel cell, such as a separator, a gas diffuser, and an interchange connector. See paragraph 1 of the JP '750 reference." However, it is submitted that paragraph 1, as well as paragraph 2 of the reference, fairly suggest that the interconnect may be used as a heating element. Paragraph 2 discloses that "LaCrO3 The compound expressed is excellent in chemical stability in an elevated temperature, and since electronic-conduction nature is large, the application to the current

collection material or the ceramic heater elements of a solid oxide fuel cell, such as separator, a gas diffuser, and an interchange connector, is considered." It is submitted that the language used in both paragraph 1 and paragraph 2 fairly suggests that the interconnects or separators may be used as heating elements. It is acknowledged that that the language is somewhat awkward and contains grammatical errors as a result of being generated by a computer. Nevertheless, it is believed that the language is sufficiently clear so as to suggest the claimed invention to a skilled artisan without the benefit of hindsight.

Applicants further state that "neither the JP '750 reference nor the Lessing et al. teach or suggest, alone or in combination, elimination of a separate heating element while retaining its function with respect to the interconnect." However, it is submitted that the ceramic material of JP '750 is inherently capable of performing both a current collecting function *and* a heating function. Thus, the interconnect of the JP '750 reference would be inherently capable of heating the fuel cell. Further, as set forth above, the reference teaches in paragraphs 1 and 2 that the heating element of a solid oxide fuel cell may be the interconnect. Accordingly, it is believed that the JP '750 reference teaches the retention of a heating function in its solid oxide fuel cell interconnect.

Conclusion

8. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Crepeau whose telephone number is (703) 305-0051. The examiner can normally be reached Monday-Friday from 9:30 AM - 6:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski, can be reached at (703) 308-4333. The phone number for the organization where this application or proceeding is assigned is (703) 305-5900. Additionally, documents may be faxed to (703) 872-9310 (for non-final communications) or (703) 872-9311 (for after-final communications).

Any inquiry of general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

JSC

September 14, 2003

RANDY GULAKOWSKI
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700